REMARKS

In response to the non-final Office Action, dated July 18, 2002, the applicants hereby make the following response. Claims 1-29 are currently pending with claims 1, 5, 6, 8, 11, 13, 18, 20, 24 and 26 being independent. In this response, claims 1, 3-7, 11-14, 18, 19 and 24-27 are being amended and claims 2, 8-10, 15-17, 20-23 and 28, 29 are being canceled.

In The Specification

The Abstract has been amended as suggested by the Examiner.

Rejection Under 35 U.S.C. §112

Claims 12 and 25 stand rejected under 35 U.S.C. 112, second paragraph. Claims 12 and 25 have been amended to provide antecedent basis for all imitations.

Rejection Under 35 U.S.C. § 102(b)

Claims 1-5 stand rejected under 35 U.S.C. § 102(b) as being purportedly anticipated by *Hackleman (*U.S. Patent No. 5,600,354). However, Claims 1, and 3-5 have been amended and claim 2 has been cancelled. Applicants respectfully traverse the rejection and request withdrawal of the same.

Claims 1 and 5 have been amended to recite that the nozzles of one head chip and nozzles of an adjacent head chip overlap to form an overlap area on a print object such that the ejected inks from the nozzles mix in the overlapped area prior to adhering. Thus, by overlapping the nozzles and mixing the ink, the ink droplets adhere at substantially the same point on the print object (see specification for 29, lines 4-11). Accordingly, the mixture of the inks improves the quality of the printed object by eliminating the different characteristics of the adjacent chips by reducing the dot density difference of the ejected ink.

The *Hackleman et al.* reference does not teach driving the ink ejecting mechanism over the overlapped area to reduce dot density differences and to eliminate irregular print characteristics of adjacent chips. As such, the *Hackleman et al.* reference does not anticipate the present invention.

Rejection Under 35 U.S.C. § 103(a)

Claims 6-29 stand rejected under 35 U.S.C. § 103(a) as being purportedly unpatentable over *Allen et al.* (U.S. Patent No. 5,469,199) in view of *Hackleman*. Claims 6, 11, 13, 18, 20, 24 and 26 have been amended. Applicants respectfully traverse the rejection and request withdrawal of same.

The *Hackleman* reference relates to control circuitry for wide array print patterns. In order to design the amount of data required to selectively enable the individual heating elements, the *Hackleman* reference minimizes the amount of data necessary for each heating element by sending high level print commands to each heating element (see column 10, lines 17-23). The commands specify a range of nozzles or geometrical shapes to be printed. The *Hackleman* reference discusses overlapping nozzles in order to accommodate thermal expansion in the printhead (see column 3, lines 25-27).

The *Allen et al.* reference relates to a method of forming a printhead wherein the pattern of orifices are formed in a flexible tape using laser ablation. Since the tape is continuous along the entire length of the printhead, the nozzles are not positioned side by side in a linear array (see column 3, 5-14).

In the present invention, nozzles associated with an array are overlapped with nozzles in an adjacent array along at least one direction. As noted in the Background section of the present invention, prior art head chips positioned adjacent to each other typically emit irregular characteristics at the boundary of the adjacent head chips. As such, dot density differences such

as vertical stripes occur at the boundary leading to poor print quality (see specification page 2, lines 6-11). Additionally, the prior art does not precisely align the head chips during the manufacturing of the printheads (see specification page 3, lines 11-17). Thus, deviation of an impact point of the print object of more than a half of a dot affects the print quality.

The present invention overcomes the prior art problems by positioning nozzles in nozzle arrays in an overlapping configuration. Accordingly, the nozzles can print in an overlapped area. Thus, if the head chips are erroneously positioned, the nozzles will overlap to mix inks from adjacent head chips to reduce any printing irregularities.

Applicants respectfully submit that combining the cited references fails to establish a prima facie case of obviousness. To establish a prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art See In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). Further, not only must the Examiner find each element of the claimed invention in the prior art, the Examiner must show upon "rigorous application" the proper motivation or suggestion to combine wherein the showing "must be clear and particular" See In re Dembiczak, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 17 (Fed. Cir. 1999).

The Applicant respectfully submits that the Examiner's reference by reference, limitation by limitation analysis fails to demonstrate how the references in combination teach or suggest their combination to yield the claimed invention wherein the claimed invention improves the print quality by overlapping the nozzles to reduce the dot density differences of adjacent head chips.

The cited references do not provide any suggestion to modify the reference to obtain the claimed invention. It must be remembered, that simply because two references could be combined does not mean that they can be combined absent any clear teaching to do so. One skilled in the art would not be motivated to combine the cited references. As previously

discussed, the *Allen et al.* reference does not position the nozzle members in a side by side linear array which is the configuration of the *Hackleman* reference.

In order to meet an obviousness requirement, the requirement has to meet some suggestion that the cited references have similar features or structures. To suggest otherwise pertains to an impermissible hindsight reconstruction. The standard, rather, is whether the reference taken as a whole would have suggested the applicant's invention to one of ordinary skill in the plasma display arts at the time the invention was made.

Applicant respectfully submits that since claims 1, 5, 6, 8, 11, 13, 18, 20, 24 and 26 are patentable, all dependent claims therefrom are also patentable.

CONCLUSION

The Applicants respectfully request withdrawal of the rejection and believe that the claims as presented represent allowable subject matter. However, if the Examiner desires, the Applicants' attorney is ready for a telephone interview to expedite prosecution. As always, the Examiner is free to call the undersigned at 312-876-7518.

Respectfully submitted,

By its attorney,

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1/21/03
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. Patent Application of: Y. Ikemoto	)	
Serial No.: 09/910,617	)	Examiner: T. Nguyen
Filed: July 20, 2001	)	Group Art Unit: 2861
For: PRINTER AND PRINTER HEAD	)	

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

Please replace the paragraph on page 6 starting on line 15 with the following substituted paragraph:

In order to solve the above-mentioned problem, according to a first aspect of the present invention, there is provided a printer, wherein some of the plurality of nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles allocated to the adjacent head chips at the adjacent head chips, as viewed from the direction of feeding a print object, in order [to] for ink droplets to be adhered to almost the same point.

Please replace the second and third paragraphs on page 15 with the following substituted paragraphs:

In the line printer 11, the paper 14, which is switched by the feed direction in such a manner, is guided by the spurring roller 18 and so on such that the paper traverses over the paper tray 13. And as shown in the arrow C, the paper is ejected from the outlet placed at the front

side. In the line printer 11, between the spurring roller 18 and the outlet, as shown by the arrow D, the head cartridge 20 is placed in an exchangeable way.

The head cartridge 20 comprises the head 21 placed beneath the holder 22 having the predetermined form, in which respective line heads yellow, magenta, cyan and black, are placed. In the holder 22, the ink cartridges Y, M, C and B are to be placed respectively. Thus, the line printer 11 can print an image and so on by ejecting each color ink to be adhered onto the paper 14 from the corresponding line head.

Please replace the second paragraph on page 16 with the following substituted paragraph:

The head 21 comprises the head chips 25 placed in 4 lines, each of which corresponds to printing yellow, magenta, cyan and black colors, and which are placed across the paper 14 to form a line head. Thereafter, to the head 21, the metallic plate 26 is attached, which is fabricated to have a corrugated surface on the side of the head chips 25, and then each of the head chip 25 is connected.

Please replace the last paragraph on page 18 with the following substituted paragraph:

In the head chips 25 as described above, the shifted position of the nozzles 31 is used effectively to drive the grouped heaters 28 sequentially. Moreover, when nozzles 31 are shifted in such a manner, for the head chips 25 placed on both the upper side and lower side of the ink-flow path 33, heaters 28 are driven in the inverse direction for the driving signal. In this embodiment, for each head chip 25, the driving circuit is configured such that the driving sequence can be switched in accordance with the above-mentioned driving sequence.

Please replace the second paragraph on page 19 with the following substituted paragraph:

As shown in Figs. 5 to 11, in this embodiment, seven nozzles 31 forming each group are controlled sequentially in respective phases, from the phase 1 through phase 7, starting from the nozzle 31 at the feeding side of the paper 14. In Figs. 5 to 11, the number corresponding to each phase is given to the relevant nozzle. As shown in Fig. 5, when the paper 14 is fed, in the start phase 1, the nozzle 1, which is the nearest to the paper feeding side, is driven to print the dot D1. Then the paper 14 is fed as much as for printing by the subsequent nozzle 2 (Fig. 6), the subsequent nozzle 2 is driven to print the dot D2. Thus, by driving the nozzles 3 to 7 in synchronization with feeding the paper, the dots are printed sequentially (in Figs. 7 to 11). As a result, in this embodiment, the nozzles 31 in a group are driven such that they are driven with some time difference. Also, the corresponding nozzles 31 of each group are to be driven concurrently.

Please replace the second and third paragraphs on page 20 with the following substituted paragraphs:

In the head 21, driven in this way (Fig. 1), some of the nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles allocated to adjacent head chips as viewed from the direction of feeding a print object in order [to] for the ink droplets to be adhered to almost the same point. By this, in the line printer 11, for the overlapped area of printing dots by adjacent head chips by these nozzles, the dots printed by these adjacent head chips are mixed, so that irregular characteristics of adjacent chips are unnoticeable by mixture of these dots, thereby making it possible to prevent quality deterioration of print result.

Fig. [11] 12 is a block diagram of the line printer. In the printer 11, the interface (I/F) 43 receives control commands, text data and image data from the host system, personal computer

42, and sends them to the Central Processing Unit (CPU) 44. The console 45 is a pressing-button console attached to the line printer 11. In the printer 11, by operating the console 45, instructions can be accepted for example, setting various printing positions, testing print and so on. The display unit 46 comprises the liquid-crystal panel attached to the console panel, and, in response to the operations of the console 45, it can be used to display menus for various settings and the detailed information.

Please replace the last paragraph on page 23 with the following substituted paragraph:

In the head 21, on the semiconductor substrate 27, the heaters 28 are placed sequentially, and also on the semiconductor substrate 27, the drive circuits 29 for the heaters 28 are placed to form the head chip 25. The array of the head chips 25 forms the head 21 (Fig. 3).

Please replace the last and second to last paragraphs on page 26 with the following substituted paragraphs:

However, in this embodiment, the nozzles 31 for a plurality of head chips are made on one piece of the nozzle plate 23, on which a plurality of head chips [27] 25 are placed such that the ink beds 30 and the heater elements 28 are built in (Figs. 3 and 4). Thus, even if the head chips 25 are misplaced, it is possible to prevent misplacement of the nozzles 31 that cause the positioning errors of dots. Specifically, in the processing of making the nozzle 31 on the nozzle plate 23 made of one thin plate, photolithography technology can be applied, thereby making it possible to make the nozzles with a very high precision of 1 μm or less. Thus, it is possible to effectively prevent deterioration of print quality due to misplacement of the head chips 25.

More specifically, there is a case, as shown in Fig. 15 where the head chips are misplaced in the perpendicular direction of alignment of heads when comparing with the case of placing the

head chips 25 correctly as shown in Fig. 14. Also, as shown in Fig. 16, there is a case that the misplacement is in the direction of paper feed, and that alignment in inclining as shown in Fig. 17. Even in these misplaced cases, since the nozzle [13] 31 is correctly positioned, the misplaced head chips 25 can make a dot at the right position determined by the positions of the nozzles. Therefore, it is possible to prevent deterioration of print quality due to misplacement of dots in the same color.

Please replace the last paragraph on page 28 with the following substituted paragraph:

The following is some additional description on the above-mentioned case where a head chip having a print width is used to form a printer head. The above-mentioned head chip is created by cutting a disc-shaped silicon substrate. When creating the longer head chip having a print width, the fewer the number of head chips can be taken from the silicon substrate, [thereby lowering] lowers the yield rate. Furthermore, when creating the longer head having a print width, it is necessary to incorporate the larger number of elements such as heaters and so on into one head chip, thereby lowering the total yield rate. Besides, wiring pattern to be formed on the head chip will be longer, thereby giving more influence on the head chip by the resistance value of the wiring pattern. Therefore, for a head chip, the above-mentioned head chip 25 is preferable to a long head chip having a print width.

Please replace the paragraph on page 29 starting on line 5 with the following substituted paragraph:

In the above configuration, some of the nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles of adjacent head chips as viewed from the direction of feeding a print object in order [to] for ink droplets to be adhered to almost the same

point, thereby making it possible to prevent quality deterioration of print result caused by irregular characteristics of adjacent chips.

In The Abstract

[The present invention relates to a printer and printer head, and more particularly, to an ink-jet method printer for preventing quality deterioration of the print result caused by head chips having irregular characteristics.

In the present invention, as viewed from the direction of feeding a print object, the nozzles 31 allocated to the head chip 25 are placed so as to partly overlap the adjacent head chips 25. Furthermore, as many nozzles as necessary for a plurality of head chips are formed on one nozzle plate, on which head chips are placed to form a printer head.]

A printer head with overlapping nozzles. A plurality of head chips are formed in an array pattern on the printer head wherein a plurality of nozzles are associated with each head chip. Nozzles associated with one head chip and nozzles associated with an adjacent head chip partly overlap to form an overlapped area. When an ink-ejecting mechanism drives across a print object, the nozzles of the one head chip and the nozzles of the adjacent head chip respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

In The Claims

Please cancel claims 2, 8-10, 15-17, 20-23 and 28-29.

Please amend claims 1, 3, 4, 5, 6, 7, 11-14, 18, 19 and 24-27 as follows.

1. (Once Amended) A printer, [at least one ink-ejecting mechanism for ejecting ink droplets from predetermined nozzles is sequentially placed to form a chip head, and a head comprises said head chips in array,

wherein some of said plurality of nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles allocated to the adjacent head chips at the adjacent head chips, as viewed from the direction of feeding a print object, in order to ink droplets to be adhered to almost the same point]

comprising:

at least one ink-ejecting mechanism, the at least one ink-ejecting mechanism having a printer head;

at least one head chip formed on the printer head, the at least one head chip being formed in an array pattern on the printer head; and

a plurality of nozzles associated with each head chip wherein nozzles associated with one head chip and nozzles associated with an adjacent head chip partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one head chip and the nozzles of the adjacent head chip respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

3. (Once Amended) A printer according to claim 1, wherein [said] the ink-ejecting mechanism is driven such that a boundary is set in [said partly] the overlapped area, a spot of printing dots in [said] the overlapped area is allocated to the head chip covering either side of [said] the overlapped area, and [said] the boundary is shifted [appropriately].

4. (Once Amended) The printer according to claim 3, wherein [said] the boundary is shifted in accordance with [a] the print object.

5. (Once Amended) A printer head, [at least one ink-ejecting mechanism for ejecting ink droplets from predetermined nozzles is sequentially placed to form a print head chip, and said head comprises said head chips in array,

wherein said head chips are placed in such a manner that some of said nozzles allocated to said head chips are partly overlapped at the adjacent head chips, as viewed from the direction of feeding a print object]

comprising:

at least one ink-ejecting mechanism;

at least one head chip formed in an array pattern on the at least one ink-ejecting mechanism; and

a plurality of nozzles associated with each head chip wherein nozzles associated with one head chip and nozzles associated with an adjacent head chip partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one head chip and the nozzles of the adjacent head chip respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

6. (Once Amended) A printer for ejecting ink droplets from predetermined nozzles to form an image onto a print object, comprising

[a nozzle plate made of one thin plate, wherein a nozzle array which comprises a plurality of said nozzles is formed on said nozzle plate]

at least one ink-ejecting mechanism, the at least one ink-ejecting mechanism having a printer head;

at least one head chip formed on the printer head, the at least one head chip being formed in an array pattern on the printer head; and

a plurality of nozzles formed on a nozzle plate in a nozzle array wherein nozzles associated with one head chip and nozzles associated with an adjacent head chip partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one head chip and the nozzles of the adjacent head chip respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

7. (Once Amended) A printer according to Claim 6, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as [said] the print object to form [said] the nozzle array in a direction perpendicular to the feeding direction of [said] the print object.

11. (Once Amended) A printer, comprising: [a plurality of colors of ink for ejecting predetermined colors of ink from predetermined nozzles to form an image onto a print object, which comprises a nozzle plate made of one thin plate, wherein a plurality of nozzle arrays, each of which comprises a plurality of said nozzles, are formed corresponding to said plurality of colors on said nozzle plate]

at least one ink-ejecting mechanism, the at least one ink-ejecting mechanism having a printer head;

at least one head chip formed on the printer head, the at least one head chip being formed in an array pattern on the printer head; and

a plurality of nozzles formed within a plurality of nozzle arrays positioned on a nozzle plate, each nozzle array corresponding to a different color wherein nozzles associated with one nozzle array and nozzles associated with an adjacent nozzle array partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one nozzle array and the nozzles of the adjacent nozzle array respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

12. A printer according to Claim 11, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as [said] the print object to form [said] the nozzle array in a direction perpendicular to the feeding direction of [said] the print object.

13. (Once Amended) A printer, comprising: [a plurality of colors of ink, at least one ink-ejecting mechanism for ejecting predetermined colors of ink droplets from predetermined nozzles is sequentially placed to form a head chip, and as many said head chips as necessary for said plurality of colors are aligned to form a head,

wherein said nozzles are formed on said nozzle plate made of one thin plate, as many said nozzles as necessary for a plurality of said colors are formed at the same time,

and said plurality of head chips necessary for said plurality of colors are placed on said nozzle plate to form said head]

an ink-ejecting mechanism, the ink-ejecting mechanism having a nozzle plate;

a plurality of head chips formed on the nozzle plate, the plurality of head chips being formed in an array pattern on the nozzle plate; and

a plurality of nozzle arrays formed on the nozzle plate within the array pattern, each nozzle array corresponding to a color wherein nozzles associated with one nozzle array and nozzles associated with an adjacent nozzle array partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one nozzle array and the nozzles of the adjacent nozzle array respectively eject inks which are mixed in the overlapped area at substantially the same point on the print object to reduce dot density differences on the print object.

14. (Once Amended) A printer according to Claim 13, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as [said] the print object to form [a] the nozzle array in a direction perpendicular to the feeding direction of [said] the print object.

18. (Once Amended) A printer head [for ejecting ink droplets from predetermined nozzles to form an image onto a print object], comprising:

[a nozzle plate made of at least one thin plate, wherein a nozzle array which comprises a plurality of said nozzles is formed on said nozzle plate]

at least one ink-ejecting mechanism, the at least one ink-ejecting mechanism having a printer head;

at least one head chip formed on the printer head, the at least one head chip being formed in an array pattern on the printer head; and

a plurality of nozzles formed on a nozzle plate in a nozzle array wherein nozzles associated with one head chip and nozzles associated with an adjacent head chip partly overlap along at least one direction to form an overlapped area on a print object such that when the at

least one ink-ejecting mechanism drives across the print object the nozzles of the one head chip and the nozzles of the adjacent head chip respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

19. (Once Amended) A printer head according to Claim 18, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as [said] the print object to form [said] the nozzle array in a direction perpendicular to the feeding direction of said print object.

24. (Once Amended) A printer head [for ejecting predetermined colors of ink from predetermined nozzles to form an image onto a print object], comprising:

[a nozzle plate made of at least one thin plate, wherein a plurality of nozzles arrays each of which comprises a plurality of said nozzles are formed corresponding to said plurality of colors on said nozzle plate]

at least one ink-ejecting mechanism, the at least one ink-ejecting mechanism having a printer head;

at least one head chip formed on the printer head, the at least one head chip being formed in an array pattern on the printer head; and

a plurality of nozzles formed within a plurality of nozzle arrays positioned on a nozzle plate, each nozzle array corresponding to a different color wherein nozzles associated with one nozzle array and nozzles associated with an adjacent nozzle array partly overlap along at least one direction to form an overlapped area on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one nozzle array and the nozzles of the adjacent nozzle array respectively eject inks which are mixed in the overlapped area to reduce dot density differences on the print object.

25. (Once Amended) A printer head according to Claim 24, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as said print object to form [said] the nozzle array in a direction perpendicular to the feeding direction of [said] the print object.

26. (Once Amended) A printer head, comprising: [at least one ink-ejecting mechanism for ejecting predetermined colors of ink droplets from predetermined nozzles is sequentially placed to form a head chip, and as many said head chips as necessary for said plurality of colors are aligned to form a head,

wherein said nozzles are formed on said nozzle plate made of one thin plate, as many said nozzles as necessary for a plurality of said head chips are formed, as many said nozzles as necessary for a plurality of said colors are formed at the same time,

and said plurality of head chips necessary for said plurality of colors are placed on said nozzle plate to form said head]

an ink-ejecting mechanism, the ink-ejecting mechanism having a nozzle plate;

a plurality of head chips formed on the nozzle plate, the plurality of head chips being formed in an array pattern on the nozzle plate; and

a plurality of nozzle arrays formed on the nozzle plate within the array pattern, each nozzle array corresponding to a color wherein nozzles associated with one nozzle array and nozzles associated with an adjacent nozzle array partly overlap to form an overlapped area along at least one direction on a print object such that when the at least one ink-ejecting mechanism drives across the print object the nozzles of the one nozzle array and the nozzles of the adjacent nozzle array respectively eject inks which are mixed in the overlapped area at substantially the same point on the print object to reduce dot density differences on the print object.

27. (Once Amended) A printer head according to Claim 26, wherein [said] the nozzles are placed on [said] the nozzle plate almost as wide as [said] the print object to form a nozzle array in a direction perpendicular to the feeding direction of [said] the print object.

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